

Creating A Sustainable Energy Future



The National Renewable Energy Laboratory (NREL) is the U.S. Department of Energy's (DOE) primary national laboratory for renewable energy and energy efficiency research and development. NREL's work focuses on advancing renewable energy and energy efficiency technologies from concept to the commercial marketplace through industry partnerships.

The Alliance for Sustainable Energy, LLC, a partnership between Battelle and the Midwest Research Institute, manages NREL for DOE's Office of Energy Efficiency & Renewable Energy.

History

NREL began operating July 5, 1977, as the Solar Energy Research Institute (SERI). SERI was a federal facility dedicated to harnessing power from the sun and quickly caught national attention. In 1978, President Carter was the first U.S. President to visit the lab; fast forward to 1991, and another U.S. President, George H. W. Bush, elevated SERI to a national laboratory and changed the name to the

National Renewable Energy Laboratory. NREL became the only national laboratory with the single focus to create clean and renewable energy technologies.

Making a Difference

NREL's discoveries in renewable energy have shaped our transportation alternatives and provided options to power our homes and businesses. For example, the cost of wind energy has declined from 40 cents per kilowatt-hour when the lab was founded, to 6-9 cents today. These lower costs have helped wind energy become the fastest growing source of new electricity in the nation. The cost of electricity from photovoltaic (PV) panels, which convert sunlight directly into electricity, has dropped from several dollars per kilowatt-hour to 20-25 cents a kilowatt-hour. The projected cost of ethanol made from biomass has plummeted from almost \$6 per gallon to about \$2.60 today, helping spur the construction of the first cellulosic ethanol plants in the United States.

Fast Facts

- NREL's main 327-acre campus is in Golden, Colorado, just west of Denver.
- The laboratory also operates the National Wind Technology Center located on 305 acres, 13 miles north of Golden.
- NREL's staff of nearly 1,800 is dedicated to advancing renewable energy and energy efficiency.
- Total NREL payroll in 2009 was \$103,611,520.



NREL's main campus on Table Mountain in Golden, Colorado

Science & Technology

Research by NREL's scientists and engineers not only improves today's renewable energy and energy efficiency technologies, it develops tomorrow's innovations to meet the nation's energy goals and changes the way we power our homes, businesses and transportation.

The laboratory's science and technology teams work in the full-range of research and development (R&D), from basic science to applied research, engineering to testing, and scale-up to demonstration. Scientists and engineers at NREL are developing nanoscale materials to convert the sun's energy into electricity, improving utility-class wind turbines to pull more power from the wind and diving into the cellular structure of plants to make cost-competitive renewable biofuels. The laboratory also boasts strong R&D efforts in buildings and transportation efficiency, electric infrastructure systems, and hydrogen, ocean and geothermal energy.

Our staff has earned 45 R&D 100 awards and scores of other honors from the science and technology community. NREL recently was ranked among the top institutions worldwide in environmentally related research by the science publisher Elsevier. And, the 2008 Thomson Reuters Science Citation Index for energy and fuels ranked NREL second in the world and third in citation impact among 3,000 institutions, indicating the respect and influence NREL's scientific research has in the field of alternative energy.

Energy Analysis

Understanding current and future interactions and roles of energy policies, markets, resources, technologies, environmental impacts and infrastructure is critical to the nation's energy future. NREL analysts use their knowledge and expertise to integrate complex sets of data across several renewable energy and energy efficiency technologies. They explore policy and technology options to evaluate their implications for carbon reduction, job creation and energy security.

NREL is a leader in renewable energy market, sustainability, policy and technology systems analysis. Market analyses provide information to facilitate the understanding and application of renewable energy technologies in electricity markets. Sustainability analyses look at environmental, life-cycle, climate and other impacts of renewable technologies. Policy analyses inform policy design and investment decisions related to renewable energy technologies at the state, national and global levels.

Technology systems analyses examine the potential costs, benefits, risks and timeframes of all renewable technologies when applied singularly or in concert with other technologies. A slate of energy analysis models and tools developed by NREL help inform energy decisions across all renewable energy and efficiency technologies. Such tools and expertise also inform the direction of renewable energy research and development, and provide critical insights and pathways to commercialization and market penetration of these technologies.

Capabilities

NREL's renewable energy and energy efficiency research spans fundamental science to technology solutions.

Renewable Fuels

- Biomass
- Hydrogen and Fuel Cells
- Vehicle Technologies (advanced vehicles, fuel quality and testing)

Renewable Electricity

- Solar (PV, concentrating solar power and solar thermal)
- Wind and Water
- Geothermal
- Electric Systems (smart grid technology & standards, transmission & distribution systems integration, energy storage)
- Building Technologies (building efficiency, building-integrated PV)

Energy Science

- Chemical and Biosciences
- Scientific Computing
- Materials Science

Strategic Energy Analysis

- Technology
- Economic, Environmental and Security
- Markets
- Policy, Government and Programs



Biochemical Process Development Unit

Commercialization & Deployment

Ongoing research at NREL provides Americans with the best options for solving our energy problems. NREL focuses on increasing the speed of moving new energy technologies into the marketplace and expanding the scale at which they are used.

NREL's commercialization and deployment activities aim to accelerate new technology commercialization and remove barriers to market adoption of existing clean energy solutions. This means streamlining the way we do business, enhancing the entrepreneurial environment, providing greater access to capital and engaging strategically with industry and stakeholders.

Partnerships are at the core of NREL's strategy. We expand our reach by collaborating with industry, academia, non-profit organizations and federal agencies; state, local and tribal governments; and international institutions to commercialize and deploy renewable energy and energy efficiency technologies. The laboratory engages with the private sector through a variety of sponsored research contracting mechanisms, as well as through licensing new technologies. Through its enterprise development program and the annual Industry Growth Forum, NREL links entrepreneurs with investors, helps small businesses and supports the emerging clean energy business sector.

NREL advances integrated, sustainable energy solutions to meet local and regional energy needs by looking at the entire renewable and energy efficiency portfolio, tailoring cost-effective solutions that are based on locally available resources. NREL's deployment efforts often include a technical assistance aspect where staff help communities assess renewable options and provide training to help build a skilled, green workforce.

Partnerships

In 2009, NREL had agreements in place with 305 industry partners, 64 universities and 33 not-for-profit organizations.

NREL currently has active partnerships in 44 states and Puerto Rico.

Subcontracts

642 total active contracts currently valued at \$281.6 million.*

There were more than 130 new agreements in FY 09 with a contract value of \$73 million.

NREL had 50 new invention disclosures, a record for the lab.

(*As of December 2009, this is the NREL contract amount; funds expected to be spent over period of performance.)

Patents

Issued

- United States – 174
- Foreign – 88

Pending

- United States – 102
- Foreign – 81



NREL's 750-kW solar system on the Mesa Top



NREL Funding

More than 90 percent of NREL's funding is through DOE's Office of Energy Efficiency & Renewable Energy.

Funding FY2005–FY2009

LEED® Platinum Science & Technology Facility

185.6	180.6	260.5	241.0	339.4
14.6	29.0	116.9	87.3	185.7
200.2	209.6	377.4	328.3	525.1

Laboratory of the Future

NREL is building a state-of-the-art “Laboratory of the Future” with environmentally friendly research buildings to facilitate innovation. NREL’s South Table Mountain campus is bustling with construction activity with two projects taking shape in 2009 and 2010—the Research Support Facilities (RSF) and the Integrated Biorefinery Research Facility (IBRF).

The 218,000 square-foot RSF will be a model for sustainable, high-performance building designs. The RSF is expected to achieve an aggressive energy efficiency goal of 32,000 Btu/sq. ft. and receive a LEED® (Leadership in Energy and Environmental Design) Platinum designation. The IBRF will expand NREL’s capabilities to develop new cellulosic ethanol technologies and allow the laboratory to work simultaneously on multiple research projects with multiple research partners.

Two other major on-site renewable energy projects were completed this past year: the Renewable Fuels Heating Plant (RFHP) and the Mesa Top PV Project. The RFHP is a biomass combustion boiler that is expected to reduce NREL’s main campus natural gas use by 75 percent. The Mesa Top PV Project is a 750-kW single-axis tracking solar system that will ultimately help NREL meet its goal of using renewable energy to make its buildings more sustainable. After publicly committing to reducing its greenhouse emissions by 75 percent from 2005 to 2009, NREL achieved “carbon neutrality” in all operations for the second consecutive year in 2009.

The Laboratory of the Future is just one more asset in NREL’s portfolio that will ensure the laboratory’s leadership in addressing the nation’s energy challenges of the future.

Funding Sources (FY2009)

Office of Science	\$22,718,229
Office of Electricity Delivery and Energy Reliability	\$3,290,000
Other Federal Agencies	\$8,400,786
Technology Partnership Agreements	\$8,396,664
Inter-Lab	\$4,346,425
Other DOE	\$457,927

NREL Portfolio (FY2009) \$525.1 Million

Recovery Act	159.6
Infrastructure	65.5
Work for Others	9.6
Work for Federal Agencies	8.4
Wind & Hydro	30.3
Weatherization & Intergovt	6.4
Water	2.8
Vehicle Technologies	23
Transmission Distribution	2.8
Systems Integration	4.7
Solar	67.3
Science	18.5
Information Outreach	2.1
Integrated Deployment	12.1
Hydrogen	16.3
Geothermal	3.9
FEMP	4.4
Other DOE	7.1
Buildings	26.4
Industrial Technologies	0.8
Biomass	37.6
Analytic Studies	15.5

Recovery Act Detail (FY2009) 159.6M

Biomass	4.5
Buildings	3.4
Other DOE	0.3
FEMP	5.9
Geothermal	1.7
Hydrogen	0.3
Infrastructure	101.1
Integrated Deployment	0.5
Science	8.0
Solar	16.7
Systems Integration	2.2
Weatherization & Intergovt	6.0
Wind	9.0

in millions of dollars

0 15 30 45 60 75 90 105